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Student Attitudes and Approaches to Online Homework

David J. Doorn
University of Minnesota Duluth, ddoorn@d.umn.edu

Susan Janssen
University of Minnesota Duluth, sjanssen@d.umn.edu

Maureen O'Brien
University of Minnesota Duluth, mobrien@d.umn.edu

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Keywords
Online homework, Internet, Student perceptions, Study behaviors, Learning styles

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David Doorn University of Minnesota Duluth Duluth, Minnesota, USA
(218) 726-6613
ddoorn@d.umn.edu

Susan Janssen University of Minnesota Duluth Duluth, Minnesota, USA
sjanssen@d.umn.edu

Maureen O'Brien
University of Minnesota Duluth
Duluth, Minnesota, USA
mobrien@d.umn.edu

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Introduction

It is commonly assumed by students and instructors that homework contributes to effective learning through practice, knowledge enhancement, and active involvement with course material. Unfortunately, studies that have attempted to measure the effect of homework on actual achievement have not produced strong evidence that this is true. Instead, these studies have offered varying results indicating that the effect of homework may be positive, negative, or nonexistent. The recent development of online systems for delivering and submitting homework has potentially increased the cost while claiming to increase the benefits of homework. Developers justify the cost by claiming that online homework offers unique advantages over traditional homework, such as individualized questions and study plans, interactive involvement with the material, automatic grading, immediate feedback, convenience, and student satisfaction. But are these supposed benefits real? Do students

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find online homework more convenient or useful than traditional homework? Do all students benefit equally from online homework?

We have found no studies that have examined all of these questions at once, and those addressing similar questions have not produced definitive answers. (See Donovan and Nakleh, 2001, 2007; Ballard et al., 2004; and Nachmias and Segev, 2003, for examples of studies addressing online course components). In addition, few studies have addressed online homework specifically or examined its relationship with measures of learning. Given the mixed evidence regarding the effectiveness of homework and the paucity of studies of online homework in particular, our research begins to bridge the gap by surveying students in a number of courses making use of online homework systems, and by linking their responses to homework grades and course outcomes. This research consists of two phases. In the first we examine students' attitudes and practices related to online homework, including an exploration of the relationship between student characteristics, study behaviors, and perceived benefits of online systems. In the second phase we examine the relationship between homework attitudes, homework practices, and learning outcomes. In this paper we report results from the first phase.

Background and Purpose

College instructors tend to agree that homework is a useful mechanism for deepening student understanding of the material covered in a course, because it gives students practice with concepts and applications. This practice is believed to boost student learning outcomes. However, as class sizes have increased it has become difficult to give regular homework assignments. As a result, the choice is often between either not assigning graded homework at all, or giving homework online and using a system which makes grading less time-consuming for the instructor.

In recent years, the second option has become more widely available, and there has been a move toward the use of online tools across all levels of the educational system.[1] At the college level in particular, many schools make use of a wide range of course management systems such as WebVista or Moodle, and their use has grown dramatically over the past few years. (See Smith et al., 2009, for significant evidence of this.) In addition to these general systems, textbook publishers have also developed course management systems to accompany particular textbooks or fields of study. These systems often allow instructors to post lecture notes, handouts, and other course materials in addition to delivering online assignments, quizzes, and exams. In addition to such course management systems, there are stand-alone systems specifically intended for assigning homework, such as Pearson's MyEconLab (www.MyEconLab.com) or Southwestern's Aplia (www.aplia.com), which are not necessarily connected to a specific text. While all of these systems have the potential for developing and administering quizzes and exams as well as homework, the focus in this study is on the use of online homework only.

As Peters et al. (2002) point out, homework generally comes at a cost in terms of student and faculty time, and it is worth questioning whether the benefits outweigh this cost. The move toward online homework in particular raises a number of additional cost-benefit considerations for both instructors and students. From an instructor standpoint, a primary

[1] Annual reports by the EDUCAUSE Center for Applied Research have tracked the use of information technology (IT) by students and colleges through the use of annual surveys since 2004. The latest report can be found online at http://www.educause.edu/Resources/TheECARStudyofUndergraduateStu/187215.

benefit of online systems is that they may save time in the end, perhaps allowing for more to be spent on other course-related activities. Most online systems allow the instructor to design homework questions that are graded automatically, thus relieving the instructor of this task. In addition, regular online assignments can be given in any size class. Even in relatively small classes, where more homework has traditionally been given, having the ability to assign homework online may result in an increase in the number of assignments. In this way, online homework offers the potential to enhance student learning without significantly increasing instructor workload.

Another benefit is that some online systems allow each student to get alternate versions of the same question or alternate sets of questions covering the same topics. This tends to limit a students' ability to copy answers from classmates. Even if students work together on homework, alternate versions may increase study time spent in order for each student to obtain the answers for their particular version of the questions. This should enhance student understanding of course material, as well.

As far as costs to the instructor, at the front end there are setup costs, such as accessing a system, learning to use it and how it works for students, and determining the best way to integrate it into a course. Many instructors may also develop and upload their own questions or edit questions supplied by a publisher. The up-front time and effort in doing this may be substantial, but may subside as the system becomes more familiar.

An ongoing cost that may not subside over time involves dealing with technical issues, including problems with student access, lack of technical skills on the part of students, and server crashes or loss of access at critical times, such as prior to homework due dates. Fortunately, as systems have been upgraded over time, problems related to servers and access seem to be declining. Student technical skills also appear to be improving. Because of the continuing spread of computer and internet usage across the educational spectrum, today's students enter college with vastly greater computer experience than their predecessors of even a few years ago. All in all, technical costs seem to be declining, although they are unlikely to disappear completely.

From the student perspective there are also costs and benefits to the use of online homework. Students may now get homework in courses in which they traditionally did not, and many students feel this work helps them get a better understanding of course material. This may be more than just a perception. Using a multivariate analysis that included GPA and previous exam performance as control variables, Lass, Morzuch, and Rogers (2007) found online quizzes to have a significant positive effect on final exam scores. In addition, Emerson and Mencken (2009) found that graded online homework has a positive effect on final exam performance and course grades.

Many online systems have the potential to allow students to work practice problems before starting an assignment and to also receive feedback. This helps students identify areas where they need additional study and can also help to clarify general methodologies for approaching graded problems of the same sort. Johnston (2004) reports that students appreciated the convenience, flexibility, and feedback features of online homework. Stuart (2004), Kortemeyer et al. (2005), and Dillard-Eggers et al. (2008) provide evidence that such feedback tends to enhance student outcomes. Lindquist and Olson (2007) report that feedback increases student perception of learning and satisfaction with the final grade.

Another benefit for students is that they may be allowed more than a single attempt at each question, with their average or highest score taken when there are multiple attempts. The

earlier attempts provide feedback; students try again if they do not get a question correct; and their score is likely to improve the second time. This increases the amount of practice with the material and helps them understand what they did wrong the first time. However, Dahlgran (2006) reports that while the practice afforded by online homework does indeed improve learning, students with higher GPAs seemed to derive more benefits, and many students did not take the time to complete all the assignments.

On the cost side for students, a primary consideration is the actual monetary expense. Many stand-alone homework systems require each student to pay for access, often in addition to the cost of a textbook and/or other material. Some online homework systems, such as Aplia and MyEconLab, are now working with textbook publishers to offer an electronic version of the text, usually at a significantly lower cost, when students purchase access to the homework system. Publishers' homework systems associated with a specific text often include free access with the purchase of a new textbook, while those buying used texts must purchase access separately. Generalized course management systems, such as WebVista or Moodle, usually do not involve any monetary cost to the students, but they may require more effort on the part of the instructor to develop content.

Additional cost considerations for students include acquiring the technical skills to use online homework systems and securing access to computers and/or networks with the necessary system requirements to access and complete assignments. Over time, homework systems have improved, and most are now straightforward to implement and often provide online help. In addition, most students today have attained at least basic computer and internet skills by the time they reach college, and many students have used online systems in previous coursework, as our survey indicates. (See Salaway and Caruso, 2007, for additional evidence of the increase in IT literacy.) Access is also seldom an issue on most campuses, although off-campus access may vary among students.

While it is not difficult to identify potential costs and benefits associated with different online homework systems, of primary concern is whether their use is beneficial to the learning process, and whether students use them in such a way as to maximize those benefits. We have found no studies that provide definitive answers to these questions, and many of those that attempted to do so were conducted with small samples or single courses. In this study we begin to address these gaps by reporting survey results that pertain to student attitudes and behaviors concerning the use of online homework in a large sample that includes a variety of sections and courses. This report will focus on student perceptions, with the central questions being whether some students have more positive experiences than others and whether specific study behaviors influence those experiences. We conclude with some recommendations for instructors and an outline for future analyses that will examine learning outcomes.

Methodology

Students in fourteen sections of seven economics courses were surveyed in the fall semester of 2008. Survey responses were later linked to individual course outcomes, including homework grades, exam grades, and overall course grades. The courses were offered by the Department of Economics in the Labovitz School of Business and Economics at the University of Minnesota Duluth. The instructors in each of these sections used online systems to deliver homework which counted toward the student's overall grade for the

class.[2] Courses ranged from introductory economics and business statistics to upper division economics courses taught by a total of six different instructors. Courses, sections, and participants are summarized in Table 1.

Table 1. Surveyed Courses and Sections

Course	Sections	Respondents	HW System
Principles of Macroeconomics	3	64	Aplia
		103	
		75	
Principles of Microeconomics	2	81	Aplia
		62	
Introductory Business Statistics	5	36	WebVista
		42	
		36	Cengage
		44	
		30	
Intermediate Macroeconomics	1	30	MyEconLab
Intermediate Microeconomics	1	19	Aplia
Money and Banking	1	29	WebVista
Managerial Economics	1	36	WebVista
Total	14	687	

The majority of students surveyed (83.4 percent, or 573 of the 687 who participated) were in the introductory economics and business statistics courses. These are required courses for admission to the business school as well as for students majoring in economics. More than half of the students surveyed (58.8 percent) were using Aplia for homework. Another 110 were using the Cengage system in their statistics courses. (Cengage is a publisher-developed system that is directly integrated with the textbook. See www.cengage.com). Of the rest, 143 were using instructor developed homework assignments in WebVista, while 30 students used MyEconLab (another publisher-developed system integrated with the textbook).

The surveys were administered during the final two weeks of the semester, so students had at least one semester's experience with online homework at the time of the survey. Survey coverage included the following: students' attitudes about homework in general; perceptions of the benefits of online homework; views of online homework in comparison to traditional homework; previous experience with online systems in high school and college; actual use of practice problems, textbook, and course resources; and background characteristics such as gender, year in school, major, self-reported GPA, self-reported learning style, and motivation. The survey instrument is available from the authors upon request.

[2] Homework scores were a significant factor in determining overall grades in all of the courses surveyed, with weights given to the homework component ranging from a low of 15 percent to a high of 30 percent.

Results

Sample Characteristics

Information on participant's gender, year in school, and intended major is presented in Table 2. About two-thirds of respondents were male, and about half were sophomores. The majority were intending to major either in a business discipline or in economics, and the Principles and Statistics courses represented in the sample are required for those fields. However, more than a fifth of the respondents planned to major in other fields of study. Figure 1 shows the distributions of course grades and self-reported GPAs. Clearly, not only the best students, but also a wide range of students chose to participate in the study.

Table 2. Survey Respondent Characteristics

Gender	
Male	437
Female	248
Didn't Report	2
Year in School	
Freshman	41
Sophomore	341
Junior	188
Senior	101
Other	14
Didn't Report	2
Intended Major	
Business/Economics	524
Liberal Arts	39
Education/Human Services	20
Science/Engineering/Medicine	94
Fine Arts	4
Didn't Report	6

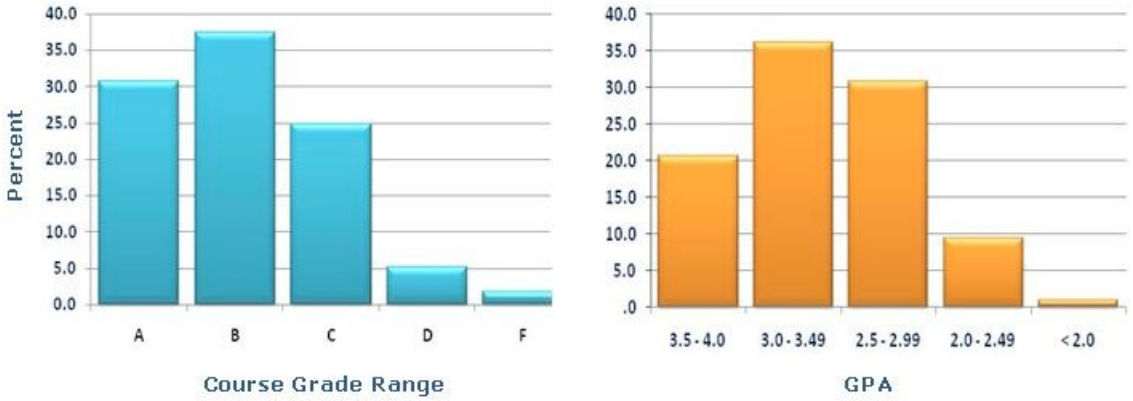

Figure 1. Distributions of Respondent Course Grades and Self-reported GPAs

The survey attempted to gauge the level of student motivation to perform well, both in the particular course being surveyed and in general across all of their coursework. Respondents were asked to rate their motivation as very high, somewhat high, average, somewhat low, or very low. According to self-reports, motivation in the courses being surveyed lagged somewhat compared to respondents' typical motivation in other coursework. While a greater percentage of respondents reported an average level of motivation in the surveyed course, the opposite was true for those reporting a very high-level of motivation. Despite this difference, motivation was not poor in any case, with only 3.6 percent reporting low or very low motivation in the course being surveyed, and less than 1 percent reporting low or very low as their typical motivation level.[3]

Table 3 displays response frequencies for students' self-perceived primary learning styles broken out by gender. (Eight participants did not respond to this question.) The students were given three styles to choose from: (1) Visual — learn best by reading, writing, using images and diagrams, or picturing concepts; (2) Auditory — learn best by hearing, reciting, or talking about material; and (3) Tactile/Kinesthetic — learn best by doing, experimenting, using computers, handling materials. Nearly half of the respondents reported that they are visual learners. Only about 15 percent reported being auditory learners. There is only a minor difference across genders, with a slightly greater proportion of male students choosing tactile/kinesthetic, and a slightly greater proportion of female students choosing Visual and Auditory styles.

Table 3. Respondent's Self-perceived Primary Learning Style

	Learning Style		
	Visual	**Auditory**	**Tactile / Kinesthetic**
Male	207	51	174
Female	126	37	84
Total	333	88	258

Table 4 shows the distribution of respondents reporting prior experience with different types of computer-assisted learning, whether in previous college courses or in high school. While only a small percentage of respondents had used computers for completing assignments or taking assessments in high school, the number increased dramatically for previous college courses. More than 80 percent of the respondents had prior college experience with submitting answers online, with slightly fewer experiencing online quizzes or tests. However, there were still a significant number of respondents for whom the course being surveyed represented their first experience with the use of online systems. More than 15 percent had not previously used such a system for submitting answers, and more than 20 percent had not used such systems for taking online quizzes or exams. Perhaps surprisingly, more than a quarter of those taking the survey had not used the internet to do any required readings or for other uses, even in previous college courses.

[3] One possible explanation for the lower level of motivation reported for the surveyed courses than for student's typical coursework may be that for a majority of the students the courses were required prerequisites for getting into their desired major program. Those not majoring in economics, for instance, might prefer avoiding those courses altogether.

Table 4. Percent Reporting Previous Experience with Computer-assisted Learning

	Used in High School	Used in College
Online system requiring submission of answers to a web site	19.9%	84.3%
Online quizzes or tests	16.2	78.0
Required readings or other resources on web sites	45.1	72.3

General Attitudes and Perceptions

The students surveyed were asked a number of questions regarding perceptions of homework in general, of traditional paper homework versus online homework, and of online homework specifically. Overwhelmingly, 85.4 percent of the students surveyed responded that graded homework is useful in learning the material, while less than 1 percent considered assigned homework useless. The remaining students consider assigned and graded homework no more useful than ungraded homework, or no more useful than studying examples or worked out problems.

When asked to compare their overall impression of online homework versus traditional paper homework, over 55 percent of the students said that they like online homework, while 35.4 percent said they don't mind online homework but don't like it a lot. The remaining 8.9 percent of the students responded that they don't much like online homework. Compared to traditional paper homework, students reported that online they required less assistance from instructors and/or tutors. They also reported that the time it takes to complete online assignments is no different than traditional assignments (43.5 percent) or is less than traditional assignments (44.1 percent). Approximately 12 percent of the students reported that the online assignments take more time.

Student perceptions are more divided when asked if they learned more or less using online homework compared to traditional pencil and paper assignments. The modal response (46.9 percent) was that they would have learned about the same amount either way. The remaining students were fairly evenly split between learning more or learning less with online homework. In sum, students reported that, in general, graded homework is beneficial and online homework is at least as effective as traditional paper homework. These results are generally consistent with the growing body of literature across disciplines that finds online homework to be at least as effective as traditional homework. For some representative studies, see Porter and Riley (1996); Dufresne, Mestre, and Rath (2002); Bonham, Beicher, and Deardorff (2003); Hauk and Segalla (2005); and Emerson and Mencken (2009).

Given that the choice is often between online homework and no homework, we did a more detailed investigation of student attitudes toward online homework. Table 5 presents frequency distributions of respondent opinions of the online homework in the particular course in which they were surveyed. Students clearly felt that the online homework worked well, with more than 90 percent of respondents either agreeing or strongly agreeing with that statement. This is encouraging, as it suggests the students do not find that the technology itself is getting in the way of learning. The students particularly liked the flexible pace at which they were able to do the online homework, with nearly half of the respondents feeling strongly about this. Many agreed that the feedback was helpful, although this statement also had the greatest number of respondents disagreeing (more than 25 percent). Students were somewhat more likely to agree that online homework

helped them in understanding the material than in preparing them for tests.[4] Altogether the generally positive view toward online homework is further supported by the fact that a majority of the respondents, more than 70 percent, agree or strongly agree that they would recommend it to others.

Table 5. Respondent Opinions of Online Homework

	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
Online homework worked well	36.4%	55.3%	2.0%	4.1%	1.6%
Online homework helped me understand the material	22.4	55.3	8.7	11.2	2.0
Online homework helped me prepare for tests	23.0	48.2	10.6	14.8	2.8
I like flexibility in pace	48.9	43.8	4.4	2.0	.4
Helpful feedback provided by system	12.2	33.2	28.2	21.1	4.5
Would recommend online homework system	22.6	48.2	16.4	8.4	3.8

Individual Differences in Attitudes

Exploratory cross-tabulation analyses were run focusing on four of the most tangible benefits of online homework: usefulness in understanding the material, usefulness in preparing for tests, feedback, and flexibility in pace. Student characteristics that were examined in relationship to these benefits included course-specific motivation, general motivation, learning style, gender, year in school, nontraditional student status, major, and self-reported cumulative GPA. Pearson chi square tests were used to determine whether there was a statistically significant association between any student characteristics and the perceived benefits. Table 6 presents summary results only for characteristics that were significantly related to one or more of the perceived benefits. Due to space limitations, only the percentage of respondents within each category of student characteristics who either *agreed* or *strongly agreed* that online homework provided a particular benefit are shown. Also, we omit the percentages who were *neutral* or *disagreed* to some degree. Relationships with learning style, gender, and non-traditional student status were found to be insignificant.

[4] This difference may be due to the fact that students don't see a direct connection with the tests if time between the assignments and the tests is long or if the questions on the test don't match up with the type of exercises done as a part of the homework. For instance, in statistics the homework is similar to end of chapter problems. In addition to these types of problems the test may also include more conceptual questions in a different format, say multiple choice.

Table 6. Percent who agree with perceived benefit, by student characteristics

Characteristic		N	Helped in understanding material	Helped prepare for tests	Liked flexibility in pace	Provided useful feedback
Specific Motivation	Very/somewhat high	508	80.0**	75.1**	93.1**	65.0**
	Average	150	75.3**	64.7**	96.0**	66.0**
	Somewhat/very low	25	48.0**	44.0**	76.0**	48.0**
General Motivation	Very/somewhat high	584	78.3*	71.5	93.7	64.7
	Average	94	77.7*	72.3	89.4	61.7
	Somewhat/very low	6	50.0*	66.7	100	83.3
Cumulative GPA	3.5-4.0	142	86.6*	76.6	94.4**	74
	3.0-3.49	248	77.4*	71.4	94.0**	62.9
	2.5-2.99	212	75.9*	69.7	93.4**	63.2
	2.0-2.49	65	67.7*	67.7	87.7**	54.3
	Under 2.0	7	57.1*	57.7	71.4**	71.5
Intended major	Business/Econ	524	81.1*	76.6**	94.1*	63.7
	Liberal arts	39	66.7*	56.4**	87.2*	66.7
	Educ./human services	20	50.0*	40.0**	90.0*	60
	Science/Eng/Medicine	93	75.0*	58.1**	91.4*	68.8
	Fine arts	4	71.0*	50.0**	75.0*	75
Year in school	Freshman	40	75	48.7**	92.5	80
	Sophomore	341	74.8	67.7**	93.9	65.7
	Junior	188	78.1	74.9**	91.4	61.2
	Senior	101	87.1	86.1**	94.1	61.3
	Other	14	92.8	78.6**	92.9	57.2

* test significant at the .05 level, ** test significant at the .01 level

Of the student characteristics studied, only course-specific motivation was related to all four perceived benefits of online homework. Cumulative GPA and intended major were associated with three of the four benefits, and general motivation and year in school were associated with one benefit. Gender, learning style, and nontraditional student status were not associated with any of the perceived benefits. The most consistent effect observed is that students with low or somewhat low course-specific motivation view online homework as less beneficial than those with average or high motivation. This could be a function of the amount of homework actually done, or a reflection of attitude toward the course in general.

Students in business, economics, science, engineering, and medicine view online homework as more beneficial than those in liberal arts, education and human services, and fine arts. However, the differences are not large, and it should be noted that the courses surveyed were required for business and economics majors — the group which tended to evaluate the online homework most positively. It is possible that motivation plays a role, and students may approach courses in their majors more seriously than electives. Students with higher GPAs evaluated two of the benefits more positively — increased understanding of material and flexibility in pace. Motivation will be discussed in more detail later in this paper.

The remaining characteristics are not strongly related to perceived benefits of homework. Since the sample as a whole tended to evaluate all of these benefits positively, it may be concluded that students across the board, regardless of gender, learning style, major, or academic rank, can benefit from online homework.

Study Behaviors

Homework may have benefits, but students vary in how they approach and use homework assignments. Do some study behaviors result in greater benefits than others? The present research did not measure study behaviors in depth, but students were asked how they approached the homework assignments, readings from the text, time management, and cooperative studying. Any of these behaviors may potentially work to enhance or hinder the beneficial effect of homework. In this section, we describe cross-tabulation analyses exploring the relationship between study behaviors and the four perceived benefits of homework. The behaviors tested included the following: students' approach to practice questions (before doing graded assignment, while doing graded assignment, not at all); use of the textbook (before doing graded assignment, while doing graded assignment, only to study for tests, not at all); when they began working on an assignment (more than 2 days, 1-2 days, less than one day before due date); with whom they worked on assignments (alone, with others in class, with tutor, with others not in class); and strategies used when help was needed with an assignment (figure out from course resources, ask another student to help figure it out, ask another student for answer, ask instructor or tutor for help). Pearson chi square tests were again used to determine whether there was a statistically significant association between any of the study behaviors and the perceived benefits. All of the study behaviors were found to be associated with one or more of the perceived benefits. Because of space limitations, Table 7 presents only the percentage of respondents within each student characteristic category who *agreed* or *strongly agreed* that online homework provided a particular benefit.

Table 7. Percent who agree with perceived benefit of homework, by study behaviors

		N	Helped in understanding material	Helped prepare for tests	Liked flexibility in pace	Provided useful feedback
Approach to practice questions	Before graded HW	217	83.4*	73.3	96.3	77.4**
	During graded HW	132	74.2*	66.7	92.4	68.2**
	Did not do	323	75.5*	71.2	91	54.8**
Approach to reading text	Before graded HW	116	87.1**	73.0**	91.4*	70
	During graded HW	305	77.7**	70.1**	94.1*	63.9
	Study for tests only	102	68.6**	60.8**	89.1*	62.7
	Did not read text	161	78.3**	80.7**	95.0*	62.7
Typically began homework	> 2 days before due	109	89.9**	83.5**	98.1**	70.7
	1-2 days before due	379	79.7**	74.0**	94.7**	65.4
	< 1 day before due	194	67.5**	59.8**	87.1**	59.3
Whom worked with on HW	Worked alone	498	78.5	70	92.4	67.7
	Others in class	179	76.5	75.4	96.1	57.5
	Tutor	4	100	100	75	25
	Others not in class	4	50	75	100	25
Strategy used when help needed	Refer to course materials	546	78.9	70.4	93.2	67.4*
	Ask student for help	96	71.9	74	93.8	57.3*
	Ask student for answer	28	82.2	86.2	92.9	53.6*
	Ask instr./tutor for help	12	75	83.4	91.7	25.0*

* test significant at the .05 level, ** test significant at the .01 level

Study behaviors appear to be moderately related to perceived benefits of homework. In general, students who did practice problems before doing graded homework, read the text prior to doing the homework, and started the homework earlier were more likely to report that the homework helped them understand the material and prepare for tests. While these behaviors are indicative of greater organization and planning, it may also be that students who perceived the homework as useful were more likely to take an organized approach, or both. Flexibility in pace was appreciated more by those who started the homework earlier (thus being able to take advantage of flexibility) as well as those who did not read the text or read only the parts that pertained to the homework. These differences are small, however, and nearly all students felt that flexibility was beneficial. Feedback was perceived as most beneficial by those who worked practice questions in advance, worked alone rather than with others, and used course resources (rather than asking others for help) as a first step when they encountered difficulty with homework. These results indicate that the feedback feature of online homework systems is a useful resource which students may use in place of or in combination with group study.

Motivation and Behavior

We have established that motivation and behavior are individually related to the perceived benefits of online homework. Students who are highly motivated and/or use the materials in an organized manner evaluate the potential benefits more positively. To tentatively explore a causal link between these variables, we examined whether motivation is associated with more organized study. Cross-tabulation analyses were performed to determine whether course specific motivation is associated with approach to practice questions, textbook use, and time when homework was started. The results indicated that motivation was not significantly associated with the approach to practice problems ($p = .262$)[5], but it was related to textbook use ($p = .024$) and the time when homework assignments were started ($p < .000$).

Among students whose motivation to do well in the course was “very high,” 25 percent reported reading the text prior to starting the homework, compared to none of those whose motivation was “somewhat low” or “very low.” In contrast, 44 percent of those whose motivation was “somewhat low” or “very low” reported not reading the textbook at all. Similarly, 29 percent of those whose motivation was “very high” started the homework assignments more than two days before the due date, and another 52 percent started it 1-2 days before it was due. Among those whose motivation was “somewhat low” or “very low,” only 12 percent started homework more than two days before the due date, and 52 percent waited until the day it was due. (It should be noted that only 25 students reported their motivation as being somewhat or very low).

In sum, it seems there is a relationship between course specific motivation and study behaviors, with the more highly motivated students taking a more organized approach to studying. In turn, the more organized students were with respect to study behaviors, the greater benefits they perceived from homework.

Required or Optional Homework?

The preceding sections have established that online homework is viewed by students as having concrete benefits, and that motivation is one factor determining whether a student

[5] It should be noted that among those whose motivation was “very high” or “somewhat high” about 55% reported doing the practice problems at some point. Among those whose motivation was “somewhat low,” or “very low,” about 67% did not do the practice problems.

uses homework in such a way as to realize the benefits. Emerson and Mencken (2009) found that non-required homework can have similar benefits to graded homework. For students who recognize this and want to do well in a course, a rational approach would include doing homework regardless of whether or not it is graded. A willingness to do "voluntary" homework could be taken as an indicator of the value of homework to a student. This section examines students' opinions about whether they would have done the homework if it were not graded.

In all of the courses included in this study, homework was a part of the student's grade. Therefore, we do not know whether students would *actually do* homework without the incentive of a grade. But the students were asked whether they "*would have done* the homework even if it were not graded." Although one may question the validity of this item as a measure of what students would actually do, it may be a reasonable indicator of students' ideal approach to a class. Furthermore, the variability in the responses indicates that students do not just give the socially acceptable answer.

Despite the fact that students expressed positive attitudes toward online homework and perceived that it had benefits, only 5.7 percent strongly agreed and 21.8 percent agreed that they "would have done the homework even if it were not graded." Over 52 percent disagreed or strongly disagreed with this statement. It seems that although most students felt that homework was useful, most admit that they would not do it unless required. Certain students, however, were much more likely to respond positively to this question.

Cross-tabulation analyses were conducted to determine which attitudes and characteristics predict a willingness to do homework even if not graded. Because of space limitations, only summary results for significant relationships are presented in Table 8. Relationships that were tested but were not significant included homework platform, previous experience with online assignments, motivation to do well in most other courses, gender, primary learning style, year in school, intended major, and nontraditional student status.

Table 8. Percent of respondents who agree that they would do homework even if not graded, by selected characteristics

Opinion statement (benefits of online homework)	**Strongly agree with statement**	**Strongly disagree with statement**
Online homework helped me prepare for tests**	35%	11%
Online homework helped me understand the material**	45%	14%
Online homework worked well**	36%	18%
Helpful feedback was provided by the system**	34%	8%
Online vs. Paper Homework	**"More "**	**"Less"**
Liked online vs. paper homework**	33%	18%
Learned more with online than paper homework**	37%	17%

** significant at the .01 level. Some response categories are omitted to save space.

There is a positive association between each of the perceived benefits of online homework and reported willingness to do the homework even if it were not graded. The strongest association is found with the statement that "online homework helped me prepare for tests," closely followed by "online homework helped me understand the material." Somewhat weaker positive associations are found with the opinions that online homework worked well, provided helpful feedback, was liked better than paper homework, and enabled the

respondent to learn more. These findings are consistent with the notion that students who view the homework as beneficial to their learning and performance will be more likely to do it, even without the external motivation of a grade.

Few individual characteristics are associated with willingness to do homework if not graded. Parallel to earlier findings with respect to attitudes about homework, motivation to do well in the course has the strongest relationship. Of those who said their motivation was "very high," 42 percent agreed or strongly agreed that they would do the homework even if it were not graded. Of those who said their motivation was "somewhat high," 23 percent agreed or strongly agreed. Of those whose motivation was "average" to "very low," only 19 percent strongly agreed or agreed. Women were slightly more likely than men to agree or strongly agree (31 percent vs. 25 percent). Among those with a GPA between 3.5 and 4.0, 41 percent would do the homework even if it were not graded. Among those with a GPA of 2.5 or less, only 22 percent would do ungraded homework. Taken together with our earlier analyses, these findings further support the notion that motivation and perceived benefits are important factors in students' attitudes about online homework.

Homework Platforms

Clearly, there are good reasons for college and university instructors to use online homework in their courses. Thus far, we have examined the perceived benefits to students and the factors influencing them. A final issue for instructors to consider is whether one platform or system may be better than others for delivering online materials. In the present study, four different platforms were included. Aplia (stand alone or linked to the textbook) was used in three different courses, including Principles of Microeconomics, Principles of Macroeconomics, and Intermediate Microeconomics, by a total of 404 students. WebVista (a course management system) was used in Introductory Business Statistics, Money and Banking, and Managerial Economics by a total of 143 students. Cengage (textbook dependent) was used in three sections of Introductory Business Statistics by a total of 110 students. MyEconLab (stand alone or textbook dependent) was used in Intermediate Macroeconomics by 30 students. Space does not permit an exhaustive examination of differences between these platforms, nor is there enough variation in the classes using each to separate the effect of platform from the effect of specific course. All of the systems were evaluated positively and perceived to have benefits to the students. However, exploratory analysis did produce some difference in the degree to which students reported these benefits. A brief summary of only significant findings is displayed in Table 9.

Table 9. Summary of significant differences between homework platforms

Test variable	Aplia	WebVista	MyEconLab	Cengage
Helped understand material (SA/A)**	73%	76%	83%	86%
Helped prepare for tests (SA/A)**	60%	91%	83%	96%
Liked flexibility (SA/A)*	92%	93%	100%	97%
Received helpful feedback (SA/A)**	72%	53%	73%	44%
Would recommend system to others (SA/A)**	66%	78%	83%	80%
Online required less assistance than paper HW*	54%	39%	53%	61%
Learned more with online than paper HW**	30%	21%	40%	32%
Liked online HW**	49%	59%	67%	72%
Completed practice questions before/during HW**	64%	42%	21%	29%
Read textbook before/during HW**	63%	42%	61%	83%
Started HW more than 2 days before due date**	12%	17%	40%	23%
Did HW alone rather than with others**	82%	62%	97%	48%
Used class resources first when help was needed**	88%	67%	93%	63%
"Very high" motivation to do well in this class**	26%	40%	20%	30%

* test significant at the .05 level, ** test significant at the .01 level. SA/A indicates response of *strongly* agree or agree. Some response categories are combined or omitted to save space.

Conclusions from these comparisons must be undertaken with caution. Only two of the platforms, Aplia and WebVista, were used in more than one course (3 each). MyEconLab was used by only 30 students. Therefore the differences reflected in Table 9 may be due as much or more to variations in the type of material covered or instructors' structuring of the courses as they are to the platform itself. Comparing Aplia and WebVista — the two most widely used platforms in this study — it appears that students perceived WebVista as more useful in preparing for tests but less helpful in providing feedback. Overall, students appeared to like WebVista more than Aplia (based on recommending it and liking online homework), but felt that WebVista required more assistance to use. Those using Aplia were more likely to do the practice questions, work alone, and turn to course resources when they needed help. More students using WebVista reported being "highly motivated" to do well in the course.

These findings may be explained in part by the characteristics of the systems and the courses in which they were used. Aplia makes use of "hands on" methods, including graphs which the user can manipulate. Feedback may be visual. WebVista is more suited to standardized material, although open-ended questions may be used. Many questions used with WebVista do not necessarily include any feedback beyond revealing the correct answer. The "principles" courses that used Aplia are difficult, and this may explain why students liked Aplia less but used it to practice more and read the textbook more. Two courses are also large lecture courses, which may explain why students using Aplia worked alone more. Alternatively, students may have been able to figure out Aplia problems with less help from others. Overall, the differences between the platforms are not large, and in general, the benefits of online homework may be derived from any of them.

Discussion and Conclusions

This paper has addressed two primary questions. The first involved an assessment of the benefits to students of online homework, while the second asked whether individual characteristics and behaviors are associated with perceived benefits from online homework.

We believe the answers we have found are useful and can be generalized. Although our sample contains disproportionately business and economics majors, and is not necessarily representative of a general population of university students, there is a good distribution of gender, year in school, learning styles and grade point averages. The homework platforms compared also are used in other disciplines.

Benefits of Online Homework

The students in this survey overwhelmingly reported that online homework was beneficial in understanding material and preparing for exams. They liked its flexibility and immediate feedback. They felt that it was at least as easy to use as traditional homework, and most would recommend it. Since this is not a controlled study, there is no comparison group using traditional (paper and pencil) homework, and it is impossible to say whether online homework is better or worse than traditional homework. However, this study still provides useful information in the sense that online homework is here to stay. It is being used regardless of how it compares to traditional homework, and it is often assigned in large classes where traditional homework would not have been an option. If the choice is between giving online homework or no graded homework at all, our results indicate that online homework may be a good choice.

Contrary to expectations, we found few individual characteristics that were associated with perceived benefits of online homework. Previous experience with online systems, year in school, gender, and learning style had little relationship to students' attitudes about the homework, indicating that online systems may be positively received by a general and diverse population of students.

Perhaps especially surprising is the fact that learning style is not associated with student attitudes about homework. There are a number of learning style models (e.g. Kolb, 1984; Felder and Silverman, 1988; Herrmann, 1995; and Dunn, 2000), and as noted by Miller (2005), the academic community has not settled on one single instrument to measure learning preferences. It is possible that the dimensions we defined to describe learning styles are not refined enough to capture an association between learning style and attitudes, or that another learning style model would be more appropriate. It is interesting to note the response "strongly agree that the assignments helped me understand the material" was proportionally equal (22 percent) among students who identified their primary learning styles as visual and those who self-identify as tactile/kinesthetic. Online activities are usually associated with the tactile/kinesthetic dimension. However, the online homework assignments in economics frequently involve graphs and diagrams, appealing to visual learners as well.

Only grade point average and course specific motivation were consistently associated with stronger positive attitudes about the homework. Although we cannot establish causality using the data we have collected, it seems likely that motivation could influence the perceived benefits of homework. Students who want to do well in a class put more effort into the homework and derive more benefit. This notion is supported by the finding that highly motivated students took a more organized approach to the homework, including doing ungraded practice problems, starting assignments earlier, reading the textbook before doing homework, and stating that they would have done the homework even if it were not graded. It is also consistent with earlier findings by Dahlgran (2006), which suggest that students attempt to maximize the marginal benefit of spending time on homework. Using a different definition of motivation, Peng (2009) examines "need for cognition," and suggests that online homework can help students with low intrinsic motivation "if they perceive…the online homework system to be advantageous to their learning."

Consistent with most other studies, we find that individual academic and demographic characteristics are not strongly related to attitudes, motivation, or study behaviors. Taken together, these findings suggest that benefits of online homework are not limited to a particular group, and an instructor can potentially have considerable impact on students' use of online resources. If instructors know that certain behaviors are associated with greater benefits, they should make an effort to encourage these behaviors and point out the benefits to students. Examples of things that instructors can do include allowing multiple attempts, reminding students to start assignments early, and recommending that they read the text and do practice assignments.

Recommendations for Instructors

Our findings suggest that online homework is a useful and worthwhile tool in college courses, and that instructors can potentially design homework to help students derive maximum benefits. Because students appreciate feedback and flexibility, assignments should be set up to provide these features. Where appropriate, an explanation of why an answer is correct, the strategy for solving a problem, or even a reference to a page in the textbook may be incorporated into the system. Some publisher-provided content already contains these features. Flexibility may involve making assignments available well in advance of the due date and allowing multiple attempts (which also are a form of feedback). Because students will make greater use of homework that helps them understand the material and prepare for tests, instructors should select or write questions that cover important concepts, are similar in format to questions on the exams, and provide an opportunity to practice for the exams.

Motivation seems to be one of the most important factors influencing students' use of homework and the benefits they obtain from it. Can instructors directly influence motivation? Some skilled and charismatic instructors may be able to do so simply through personality or enthusiasm, but more often it is success in the course (as evidenced by feelings of understanding and actual grades) that compel students to work hard. Instructor behaviors that promote individual success with online homework, such as those mentioned above, may help motivate students to use the system to maximum benefit. Encouraging good study behaviors may also be effective. Once students realize that they can succeed, motivation increases.

This study cannot shed much light on differences between homework platforms or systems. There was not enough variation in the courses using each system to make meaningful comparisons. The limited comparisons we are able to make suggest that the benefits of the four systems are similar, and none reveal any obvious problems or disadvantages. Instructors may want to base their decision on other criteria, such as cost, ease of use for the instructor, and the need to include different kinds of course materials in the package.

Future Research

Attitudes toward online homework and its potential benefits are certainly important to students, but they may exist only in students' minds. Whether homework actually promotes greater understanding of the material, or whether success on homework assignments leads to success on tests, are two different questions. In addition to the items reported here, our study tracked students' homework grades, exam scores, and final course grades. In the next phase of our research, these learning outcomes will be studied in relationship to perceived benefits of homework, study behaviors, and individual characteristics and motivation. Two of the perceived benefits that are often associated with online systems are flexibility and individual feedback. It would be especially informative to examine the

relationship between these features and student performance. We plan to address these questions in our next phase.

Future studies of online homework should include a more diverse student population. Our sample is heavily weighted toward business and economics majors. It would be helpful to know whether the findings are generalizable to other disciplines and courses. Additionally, cultural diversity could not be adequately addressed in this study, due to the homogeneity of the student population at the university where it was conducted.

In this study, motivation, especially course specific motivation, was shown to have strong effects on students' attitudes about online homework. Future studies might attempt to identify more specifically how motivation could be influenced by instructor behaviors or course design. Longitudinal research might reveal how motivation develops or changes over a semester's time, especially in terms of its relationship to student performance and feedback.

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